

ChEESE

WP2: SPECFEM3D

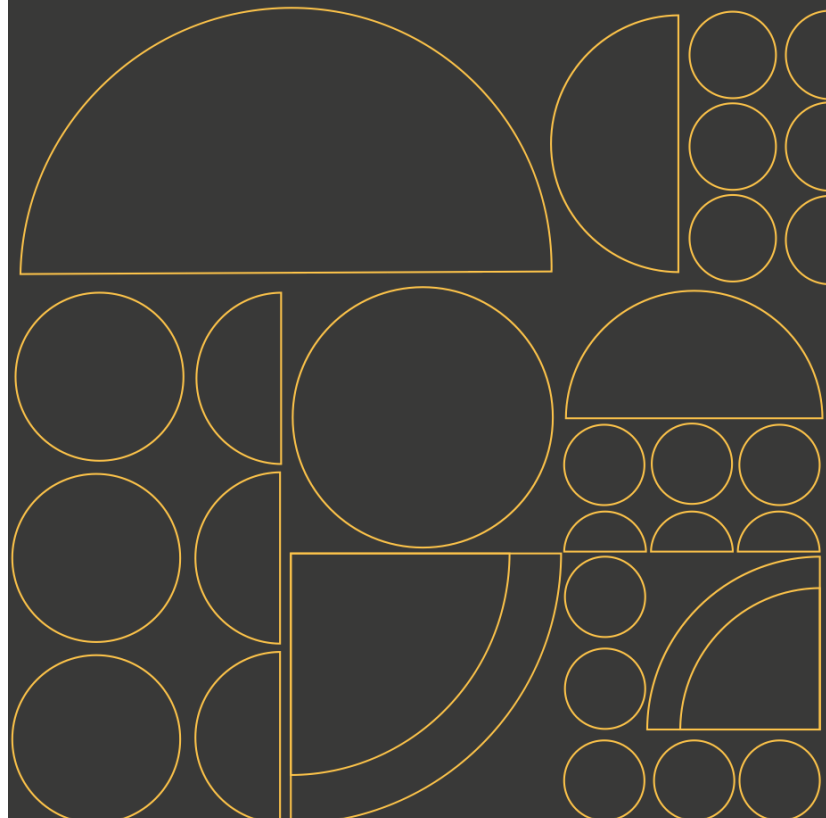
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CNRS



Funded by the European Union. This work has received funding from the European High Performance Computing Joint Undertaking (JU) and Spain, Italy, Iceland, Germany, Norway, France, Finland and Croatia under grant agreement No 101093038.



EuroHPC
Joint Undertaking



SPECFEM3D

→ Solves linear seismic wave propagation (elastic, viscoelastic, poroelastic, fluid-solid) and dynamic rupture problems in heterogeneous 3D models.

→ Seismic imaging and FWI for such complex models based on an L-BFGS (Broyden-Fletcher-Goldfarb-Shanno) algorithm.

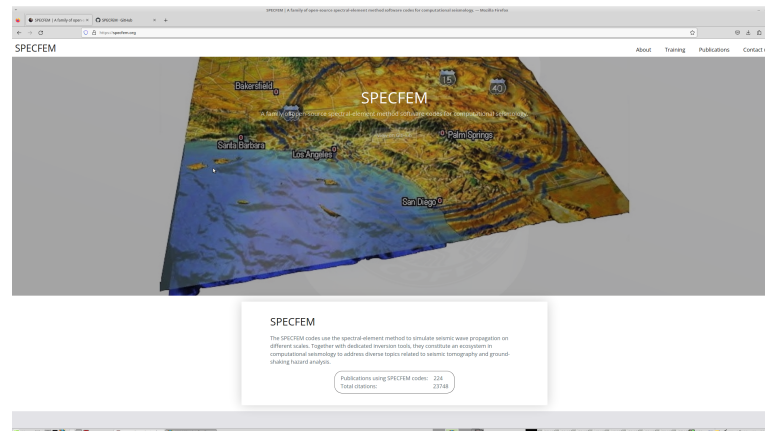
→ Based on the high-order spectral-element discretization for unstructured hexahedral meshes,

→ SPECFEM3D was originally (early 2000s) developed to perform wave propagation computation in the Earth and afterwards extended to other application domains; e.g. non-destructive testing, seismic tomography and ocean acoustics.

Web: <https://specfem.org/>

Github : <https://github.com/SPECFEM>

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SPECFEM3D

- Coded in Fortran, c, cuda and HIP
- Parallelization : MPI
 - domain decomposition (non blocking P2P communication)
 - ensemble runs (2 neested MPI communicators) suitable for FWI

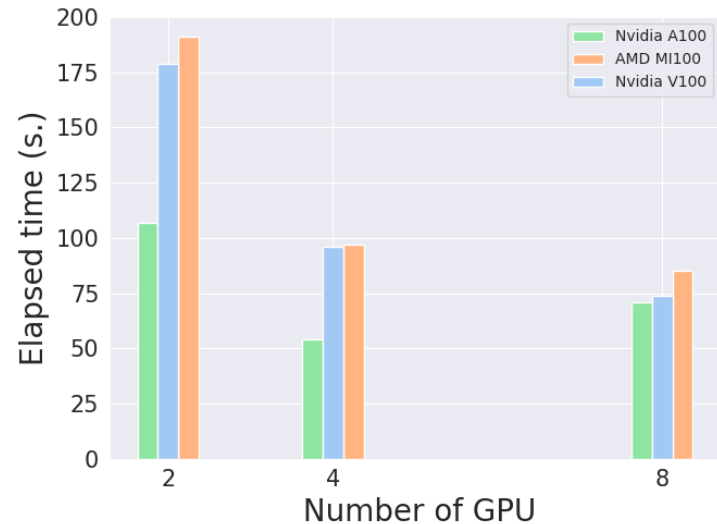
Supported platform :

CPU : intel, amd

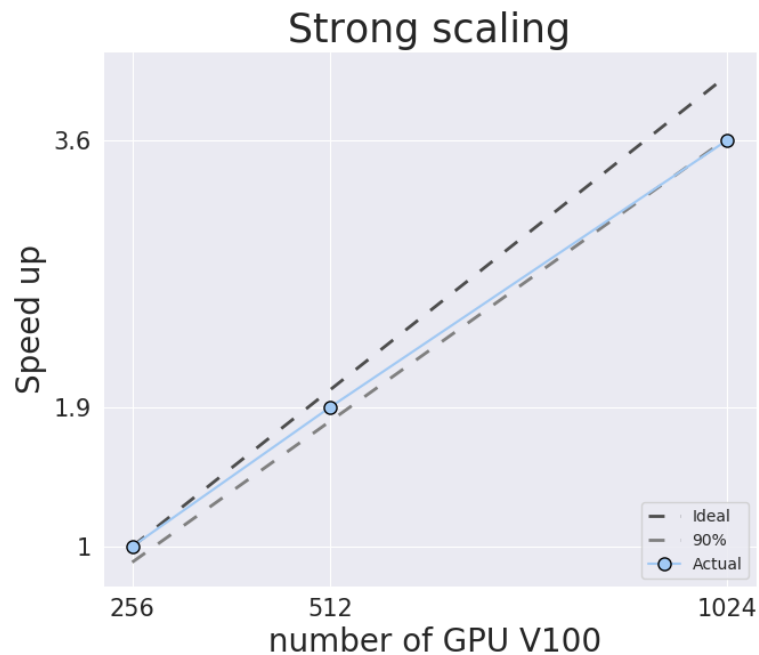
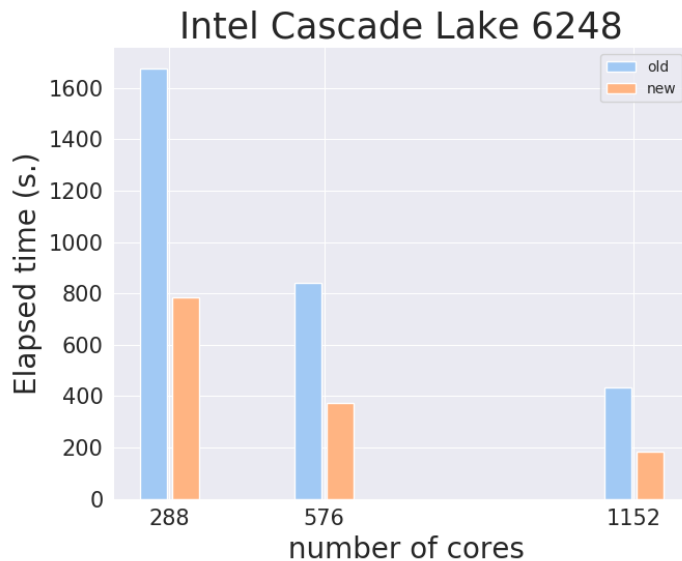
GPU : nvidia (cuda) and AMD (hip)

Improvement in ChESSE 1 :

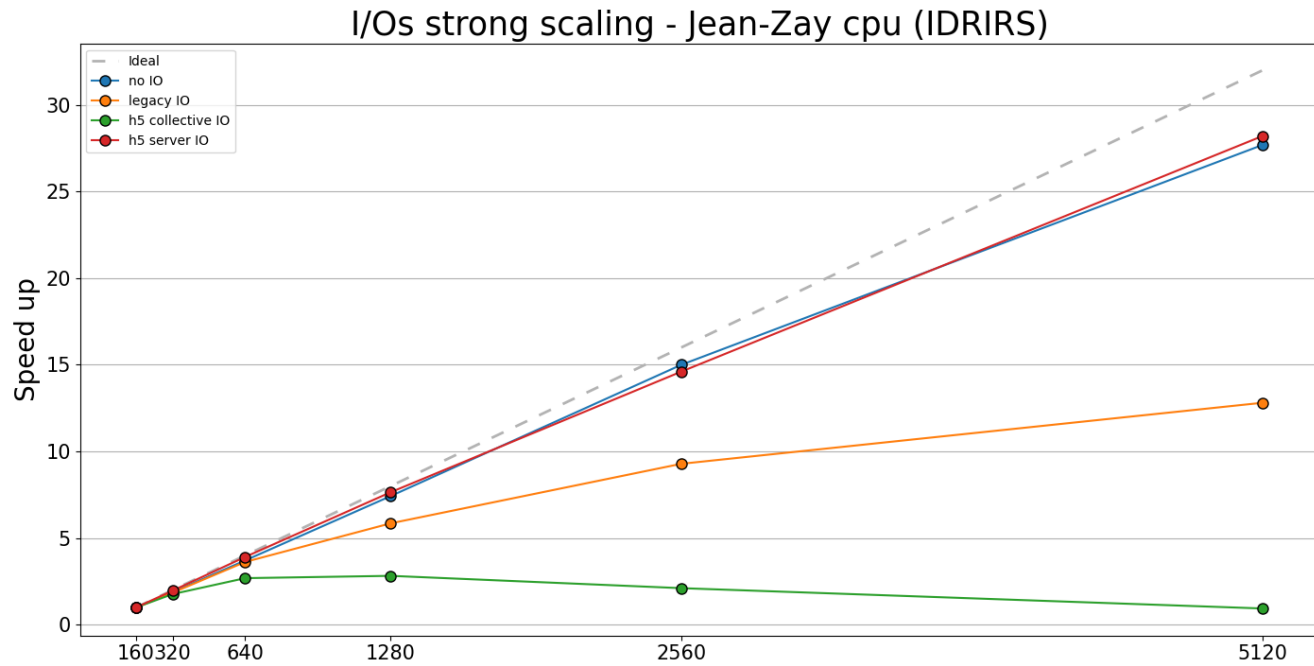
- Non blocking I/Os (cpu)
- CPU vectorization
- HIP support (AMD GPUs)



SPECFEM achievements



SPECFEM achievements



SPECFEM : planned improvement

GPU

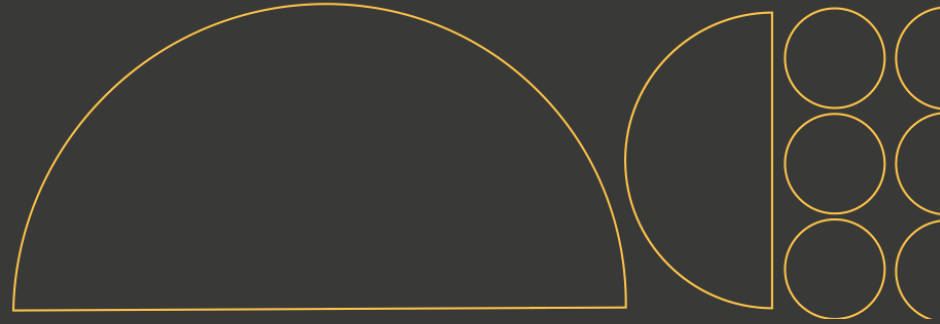
- Non blocking I/Os
- GPU direct for direct MPI communications between GPUs
- Parallel partitioner to support few billion elements

Follow development started in ChEESE 1P:

- memory compression of certain arrays to increase memory throughput



Thank you!



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<http://cheese2.eu>



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